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QUATERNARY FISH FOSSILS FROM WEST OF LAKE RUDOLF, KENYA

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INTRODUCTION

The fossils to be described in this paper were collected during the summer of 1963 by a party from the Museum of Comparative Zoology, consisting of Professor Bryan Patterson, Messrs. A. D. Lewis, C. T. Williams, and the author. It is a pleasure to acknowledge the assistance given to us by Dr. L. S. B. Leakey, and by Mr. John Walsh of the Mines and Geological Department, Kenya, who called our attention to the deposits discussed in this paper.

The late Pleistocene and Quaternary deposits west of Lake Rudolf, North Kenya (Turkana District), were visited by us during a survey of the Miocene formations in the region. Accounts of earlier visits to the region are given by Arambourg (e.g. 1943), and Fuchs (1939). A general view of the area concerned is shown in the accompanying map. A range of hills (including Losidok) west of the lakeshore is Tertiary in age, consisting of grits and volcanics. Along the base of this range there are exposed large and extensive beds of Pleistocene age — largely unfossiliferous lake beds, including conglomerates of small clay pebbles with, in places, small rocks derived from the volcanics. Away from the bases of the hills — and here we explored only eastwards — are flat plains covered with gravel and windblown sands; close to the lake large sand dunes occur. These plains extend from the hills down to the lakeshore. Nearer the lake, as Fuchs has noted (1939), there is evidence of at least two former beaches, some 220 and 90 feet above the current level of the lake. Along these beaches fossils may be found on the surface, although their derivation is difficult to determine, and "reefs" of the

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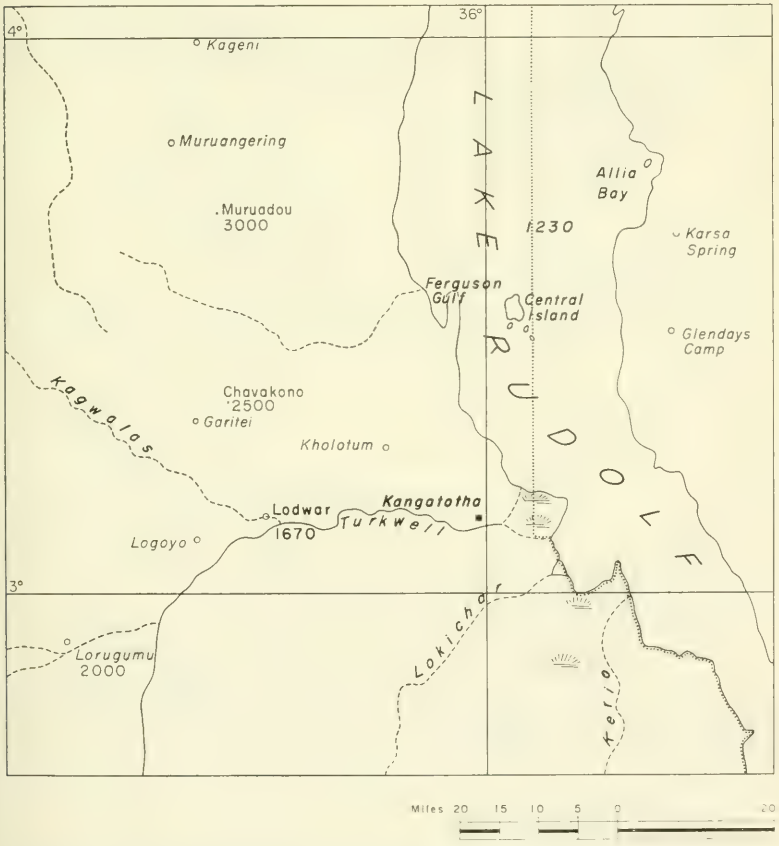
freshwater oyster, *Aetheria elliptica,* also occur. We were able to follow the beaches for several miles and found fossils even down to the lakeshore. In several places drainage from the plains has cut into the deposits and we found a number of large gullies or washes along the sides of which the bedding of the deposits — apparently with a slight eastward dip — was visible, and fossils could be collected *in situ.* The principal place from which fossils were collected was an extensive exposure at Kangatotha (see map), where the Turkwell River has made a large cut through some hundred feet of the lake deposits. Patterson and Williams measured the exposed section as follows:

Upper unit, bed	10	Surface	white sands
"	9	4 feet	black clay
"	8	16 feet	white coarse sands with gravel lenses
"	7	2½ feet	grey clay
"	6	10 feet	micaceous sand
"	5	4 feet	black clay
"	4	½ to 5 feet	coarse sand and gravel
"	3	5 feet	black clay
		¾ foot	white sand
		2½ feet	black clay
"	2	9 feet	interbedded black clays and grey sands
"	1	12 feet	black clays
Lower unit, bed	5	7 feet	fine grey sand
"	4	3½ feet	fine grey sand highly indurated with iron
"	3	5 feet	fine white sands, black micaceous flakes
"	2	4 feet	medium yellow sands, black micaceous flakes
"	1	12½ feet	coarse grey sands with large clay pebbles in upper unit (base concealed)

"Upper unit" and "lower unit" are informal, non-committal terms; formal stratigraphic naming should follow, not precede, a general survey of the Lake Rudolf Quaternary. The two units are readily distinguishable, the upper being predominantly dark in colour, the lower light. Slightly indurated fillings of plant roots are abundant in the lower unit.

Partly due to the swollen state of the river and partly due to lack of time, a similar cliff on the south bank of the watercourse, here about half a mile wide, was not visited. The tip of northern cliffs corresponds to the 220 foot level of Fuchs.

Mollusc, fish, reptilian and mammalian remains are common in the upper unit of the exposures, mollusc and fish in the lower. A human skull, a partial mandible, and various skeletal fragments were found isolated in bed 8 of the upper unit, and poorly preserved parts of a human skeleton were found in the overlying black clay of bed 9. Artifacts and pottery fragments are common on the surface and both were encountered *in situ* in bed 7 of the upper unit.



Sketch map of Lake Rudolf and the Lodwar region (Turkana District, Kenya) showing position of the Kangatotha locality.

FOSSIL FISHES

All the fish remains collected consisted of isolated bones, never associated, and very often fragmentary. Few showed great signs of weathering or of having been "rolled." The bones were highly mineralized, often showing considerable iron content, despite their relatively recent age (see below).

From lower to upper strata, the fish were distributed as follows:

Lower unit, base of bed 5, seven feet below junction with upper unit
- Order Ostariophysi
  - Suborder Siluroidea
    - Family Mochokidae
      - *Synodontis* sp.
        - Seven pectoral spine fragments
    - Family Clariidae
      - *Clarias* sp.
        - One articular (posterior portion), one quadrate (articular portion)
  - Suborder Cyprinoidea
    - Family Cyprinidae
      - cf. *Barbus*
        - Two dorsal pterygiophore fragments
- Order Percomorphi
  - Suborder Percoidea
    - Family Centropomidae
      - *Lates* cf. *Lates niloticus* Cuvier and Valenciennes
        - One incomplete parasphenoid (length 150 mm), three vertebrae (diam. 25, 33, 46 mm), four fin spines (38, 52, 55, 62 mm)
    - Family Cichlidae
      - *Tilapia* sp.
        - Two fragments of pterygiophores, six fin spines (2 nearly complete, 55 and 47 mm), two branched fin rays, and one vertebra

Lower unit, bed 5 (general)
Order Ostariophysi
Suborder Cyprinoidea
Family Cyprinidae
cf. *Barbus*
Tentatively referred to this genus are sections of two fin spines.

Order Percomorphi
Suborder Percoidea
Family Centropomidae
Lates cf. *Lates niloticus* Cuvier and Valenciennes
Four dorsal fin spines (28, 42, 45, 51 mm)

Family Cichlidae
Tilapia sp.
One pterygiophore — first interhaemal (70 mm), two dorsal fin spines (incomplete), four vertebrae: two abdominal (diam. 10, 11 mm), one caudal (diam. 15 mm), one terminal (diam. 8 mm, length 26 mm)

Upper unit, bed 5
Order Ostariophysi
Suborder Siluroidea
Family Bagridae
Bagrus cf. *Bagrus bayad* (Geoffroy)
Posterodorsal portion of a single occiput (estimated height 28-30 mm)

Family Mochokidae
Synodontis cf. *Synodontis schall* Cuvier
Humeral process of left cleithrum (49 mm long), one posttemporal bone, and fragments of four pectoral spines

Family Clariidae
Clarias cf. *Clarias lazera* Cuvier and Valenciennes
Posterior portion of dermethmoid bone (breadth 25 mm), median portion of supraoccipital (max. breadth 35 mm) and eleven vertebrae (diam. 8, 12, 13, 13, 13, 15, 15, 16, 17, 17, 17 mm)

Suborder Cyprinoidea
Family Cyprinidae
Barbus cf. *Barbus bynni* Cuvier and Valenciennes
Three dorsal pterygiophores (incomplete), one pharyngeal (length approx. 37 mm), one vertebra (diam. 6 mm)

Order Percomorphi
Suborder Percoidea
Family Centropomidae
Lates cf. *Lates niloticus* Cuvier and Valenciennes
The most abundant fish in this unit; twenty-three vertebrae (diam. 12, 13, 16, 19, 20, 20, 24, 25, 26, 26, 26, 27, 27, 30, 34, 35, 35, 37, 42, 42, 50, 51, 53 mm), the articular regions of four quadrates, one incomplete preoperculum, four incomplete fin spines, three fragments of hyomandibulars, one dermethmoid, one partial parasphenoid, two left premaxillae (proximal ends), one maxilla (distal end), and two isolated neural arches (probably from anterior vertebrae)

Family Cichlidae
Tilapia sp.
One dorsal pterygiophore, two spines, nine vertebrae (diam. 8, 7, 6, 6, 6, 6, 5, 5, 5 mm)

Upper unit, bed 8
Order Ostariophysi
Suborder Siluroidea
Family Mochokidae
Synodontis cf. *Synodontis schall* Cuvier.
The humeral process of one cleithrum (length 55 mm), one dorsal fin spine, three pectoral fin spine fragments

cf. *Synodontis*
Fragments of three spines

Family Clariidae

Clarias cf. *Clarias lazera* Cuvier and Valenciennes

Three dermethmoids (2 complete, lengths 34, 45 mm; one incomplete, anterior width 50 mm), one posttemporal, two sections of supraoccipital (one anterior, one posterior), one pectoral fin spine fragment, two vertebrae (diam. 13, 19 mm)

Suborder Siluroidea indet.

One vertebra (diam. 23 mm), two dorsal fin spines (80, 48 mm) and several spine fragments

Suborder Cyprinoidea

Family Cyprinidae

Barbus cf. *Barbus bynni* Cuvier and Valenciennes

Four pharyngeal bones (approx. length 30, 30, 40, 45 mm), two (?dorsal) pterygiophore fragments

cf. *Barbus*

Two vertebrae (diam. 14, 15 mm)

Order Percomorphi

Suborder Percoidea

Family Centropomidae

Lates cf. *Lates niloticus* Cuvier and Valenciennes

Six articular bones (posterior sections), five incomplete quadrates (articular sections), four incomplete preopercular, the proximal ends of five premaxillae, the anterior part of one right palatine, one dermethmoid, five dorsal fin spines, twenty-two vertebrae (1 second vertebra — diam. 25 mm; 3 third vertebrae — diam. 20, 23, 27 mm; 18 abdominal vertebrae — diam. 17, 20, 20, 20, 22, 24, 24, 28, 28, 28, 29, 29, 32, 33, 34, 40, 48, 49 mm), plus a number of shattered and unidentifiable fragments of large cranial elements

Upper unit, bed uncertain

These fishes were collected at one of the smaller exposures near the lake shore, about two miles north of the mouth of the Turkwell.

Order Ostariophysi
Suborder Siluroidea
Family Bagridae
Bagrus cf. *Bagrus bayad* (Geoffroy)
One occiput, incomplete (max. depth 69 mm)

?Family Clariidae
Dermethmoid portion of skull, incomplete

Order Percomorphi
Suborder Percoidea
Family Centropomidae
Lates cf. *Lates niloticus* Cuvier and Valenciennes
Posterior portion of a skull (depth of occipital region 80 mm), one premaxilla (length 127 mm), three vertebrae (diam. 29, 30, 88 mm). Note the extreme size of these specimens.

Collected on lake shore, horizon not known, but probably upper unit
Order Percomorphi
Family Centropomidae
Lates cf. *Lates niloticus* Cuvier and Valenciennes
Eight vertebrae (diam. 14, 18, 20, 24, 25, 26, 27, 30 mm) and three dorsal fin spines (40, 44, 46 mm)

Family Cichlidae
Tilapia sp.
One incomplete fin spine

DISCUSSION

Of the living species to which the fossils are most closely comparable — *Bagrus bayad*, *Synodontis schall*, *Clarias lazera*, *Lates niloticus*, *Barbus bynni*, and *Tilapia nilotica* — only *Bagrus bayad*, according to Worthington and Riccardo (1936), does not

frequent sheltered or shallow waters. *Synodontis schall* is distributed universally in Lake Rudolph. With the possible exception of the bigger *Tilapia* and *Lates*, the others are confined to the sheltered and shallower areas of the lake, such as, for example, Ferguson's Gulf. A tentative conclusion from examination of the fossils would therefore be that bed 5 of the upper unit was laid down in more open and less shallow waters than bed 8 of this unit or the upper bed of the lower unit.

An interesting feature of the fish fauna is the very great size of the largest vertebra of *Lates* from the fifth locality (lakeshore, horizon uncertain); this is far larger than is known from present-day *Lates*. Daget (1959) and White (1926) have described similar giant Quaternary *Lates*, and it is interesting to discover that such forms were still extant in such relatively very recent times, as shown in these Rudolf materials.

The nature of the fish fauna does not afford any direct evidence as to the age of the Kangatotha beds, since the Nilotic nature of the Rudolf fish fauna has been stable at least since the Lower Pleistocene disconnection of the lake basin from the Nile drainage (see Fuchs, 1939, for general chronology of the area). The mammalian fauna, so far as studied, is of Recent aspect.

The Kangatotha beds belong to the very latest stage in the history of the Rudolf basin. Their level and position would suggest that they were laid down while the lake was at its largest extent after the Gamblian Pluvial, presumably during the Makalian or Nakuran "wet phases" (see Cooke, 1957, 1963). A radio-carbon date of 4,800 ± 100 years was obtained from a sample of *Etheria elliptica* from the "beaches" on the lake shore, noted above. This attests to very recent age of the deposits and implies an extremely rapid fossilization. It is of great interest to note that the giant forms of *Lates*, described by Daget, White, and in this paper, survived to a very recent date. Finally, with respect to the time scale, a note may be added here about one of the artifacts collected on the surface of bed 7 of the upper unit. This is a uniserially barbed bone harpoon (now in the Peabody Museum, Harvard University). De Heinzelin (1957) lists the distribution of similar harpoons and gives a scheme of the evolution of harpoon design with an estimate of the equivalent culture. (To de Heinzelin's list should be added a specimen from the late Upper Kenya Capsian of Gamble's Cave described by Oakley, 1961). At first view, the Kangatotha harpoon seems to resemble the penultimate stages of design as shown by specimens from the "S.F.M." and "G.Y." levels at Ishango (de Heinzelin, 1957),

whereas the "N. tuff." specimens from Ishango, the specimen found by Arambourg (1943) at Nanoropus near the end of Lake Rudolf, and the Gamble's Cave specimen are of a more advanced style.

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